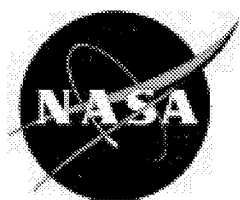


NASA/SP—1998—7037/SUPPL384
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AERONAUTICAL ENGINEERING

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Typical Report Citation and Abstract

- ❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
- ❷ Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes
- ❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
- ❹ Mar. 1996; 130p; In English
- ❺ Contract(s)/Grant(s): RTOP 505-68-70-04
- ❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
- ❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.
- ❽ Author
- ❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 384)

OCTOBER 2, 1998

01 AERONAUTICS

19980210878 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
Report to Congressional Committees. B-2 Bomber: Additional Costs to Correct Deficiencies and Make Improvements
Jun. 1998; 26p; In English

Report No.(s): GAO/NSIAD-98-152; B-278432; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The conference report on the National Defense Authorization Act for Fiscal Year 1994 requires us to report to the congressional defense committees at regular intervals on the total acquisition costs of the B-2A bomber through the completion of the production program. The last production aircraft was delivered in November 1997, and all aircraft are scheduled to be updated to the latest defined (block 30) configuration by July 2000. This report discusses deficiencies that must be corrected to achieve Air Force objectives for the B-2A, additional costs to correct the deficiencies, and the B-2A modification schedule.

Derived from text

Congressional Reports; Bomber Aircraft; Costs

19980211051 Naval Postgraduate School, Monterey, CA USA

A Comparative Analysis of the Efficiency and Effectiveness of the F-14 Tomcat Overhaul Process

Pruett, Arthur P., Naval Postgraduate School, USA; Zarkowski, Michael W., Naval Postgraduate School, USA; Jun. 1998; 116p; In English

Report No.(s): AD-A348135; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The objective of this thesis is to examine the process and managerial policies used for the F-14 Standard Depot Level Maintenance (SDLM) and compare it to the processes and managerial policies for overhaul of the F/A-18 and for the United Airlines 737. Efficiencies discovered in the F/A-18 and 737 overhaul processes that can be applied to reduce F-14 SDLM Turn Around Time (TAT) are identified. The F-14 community faces the possibility of having insufficient numbers of aircraft to satisfy fleet requirements due to excessive SDLM TAT. A 50% reduction in TAT would yield an increase of 10 to 11 aircraft available for use per year. A TAT reduction of 10% is required by the fourth quarter of Fiscal Year 1998 in order to alleviate the premature retirement of approximately 10% of the inventory (21 F-14 aircraft). This research identifies areas for potential F14 SDLM TAT improvement pertaining to planning, pre-induction requirements, and the component management policies at NADEP Jacksonville, Florida.

DTIC

Maintenance; F-14 Aircraft; Efficiency; Commercial Aircraft; Policies; Civil Aviation; Airline Operations

19980211460 Logistics Management Inst., McLean, VA USA

A Method for Making Cross-Comparable Estimates of the Benefits of Decision Support Technologies for Air Traffic Management Final Report

Lee, David, Logistics Management Inst., USA; Long, Dou, Logistics Management Inst., USA; Etheridge, Mel, Logistics Management Inst., USA; Plugge, Joana, Logistics Management Inst., USA; Johnson, Jesse, Logistics Management Inst., USA; Kostiuk, Peter, Logistics Management Inst., USA; Jul. 1998; 101p; In English

Contract(s)/Grant(s): NAS2-14361; RTOP 538-16-11-01

Report No.(s): NASA/CR-1998-208455; NS710S1; NAS 1.26:208455; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

We present a general method for making cross comparable estimates of the benefits of NASA-developed decision support technologies for air traffic management, and we apply a specific implementation of the method to estimate benefits of three deci-

sion support tools (DSTs) under development in NASA's advanced Air Transportation Technologies Program: Active Final Approach Spacing Tool (A-FAST), Expedite Departure Path (EDP), and Conflict Probe and Trial Planning Tool (CPTP). The report also reviews data about the present operation of the national airspace system (NAS) to identify opportunities for DST's to reduce delays and inefficiencies.

Author

Air Traffic Control; Air Transportation; Decision Support Systems; National Airspace System; Flight Management Systems; Aircraft Approach Spacing

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19980210969 NASA Ames Research Center, Moffett Field, CA USA

Turbulence Measurements on a Flap-Edge Model Final Report

Moriarty, Patrick, Stanford Univ., USA; Bradshaw, Peter, Stanford Univ., USA; Cantwell, Brian, Stanford Univ., USA; Ross, James, NASA Ames Research Center, USA; Sep. 30, 1996; 30p; In English

Contract(s)/Grant(s): NCC2-5140

Report No.(s): NASA/CR-1996-208291; NAS 1.26:208291; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The properties of hot-wire anemometry were studied using facilities at NASA Ames. Hot-film probes were used because of their durability, but cross-films were limited by non-linear end effects. Hot-film probes were used to measure velocities in the farfield wake of a cylinder with an airfoil in the near-field wake. The airfoil reduced the drag coefficient of the system by 10%. A single wire was used to measure velocity profiles over the top of a NACA 63(sub 2)-215 Mod. B wing with a Fowler flap and leading edge slat. Results showed the slat wake remains in the wake over the entire wing. Velocity increased through the slat gap with increased deflection. Slat serrations decreased the chance of separation. Measurements were taken at the flap edge with a single wire. Trends in the data indicate velocity and turbulence levels increase at the flap edge. The porous Revell flap modifies the mean flow near the flap edge. Correlations were made between the hot-wire signal and the unsteady pressure transducers on the wing.

Author

Velocity Measurement; Turbulence; Aerodynamic Coefficients; Flow Measurement; Pressure Sensors; Wire

19980211353 Illinois Univ. at Urbana-Champaign, Urbana, IL USA

Effects of Ice Accretion on Aircraft Aerodynamics Final Report

Bragg, Michael B., Illinois Univ. at Urbana-Champaign, USA; Feb. 24, 1998; 4p; In English

Contract(s)/Grant(s): NAG3-1681

Report No.(s): NASA/CR-1998-208313; NAS 1.26:208313; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The primary objective of this research was to support the development of a new ice accretion model by improving our physical understanding of the ice accretion process through experimental measurements. The focus was on the effect of the initial ice roughness (smooth/rough boundary) on the accretion process. This includes understanding the boundary-layer development over the roughness and especially its effect on the heat transfer which is fundamental to the ice accretion process. The research focused on acquiring the experimental data needed to formulate a new ice accretion physical model. Research was conducted to analyze boundary-layer data taken on a NACA 0012 airfoil with roughness to simulate the smooth/rough boundary. The effect of isolated roughness on boundary-layer transition was studied experimentally to determine if the classical critical roughness Reynolds number criteria could be applied to transition in the airfoil leading-edge area. The effect of simulated smooth/rough boundary roughness on convective heat transfer was studied to complete the study. During the course of this research the effect of free-stream wind tunnel turbulence on the boundary layer was measured. Since this quantity was not well known, research to accurately measure the wind tunnel turbulence in an icing cloud was undertaken. Preliminary results were attained and the final data were acquired, reduced and presented under a subsequent grant.

Author

Aerodynamic Characteristics; Aircraft Icing; Experimentation; Models; Boundary Layers; Convective Heat Transfer; Ice Formation

19980213250 Sverdrup Technology, Inc., Arnold AFS, TN USA

Assessment of Store Control Surface Effectiveness in a Non-Uniform Aircraft Flow Field

Nichols, R. H., Sverdrup Technology, Inc., USA; Evans, S. B., Sverdrup Technology, Inc., USA; Jun. 25, 1997; 14p; In English; 15th; Applied Aerodynamics, 23-25 Jun. 1997, Atlanta, GA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AD-A346160; AIAA Paper 97-2200; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Comparisons of the control effectiveness for two stores in free stream and in the flow field of a parent aircraft have been performed using computational fluid dynamics (CFD). The computations were performed to assess the changes in control surface effectiveness of the store due to the highly nonlinear flow field of the parent aircraft at transonic speeds. The Navier-Stokes equations were solved using an algebraic turbulence model for an extended range air-to-ground missile (AGM-130A) mounted on the wing pylon of an F-15E aircraft and for an air-to-air missile mounted on the forward station of the inboard pylon of an F-15E aircraft. Free-stream calculations showed good agreement with wind tunnel control surface effectiveness results for both stores. Calculations of control surface effectiveness in the aircraft flow field indicate significant changes occur for the AGM-130A missile while the air-to-air missile showed very little effect. This is attributed to the fact that a large region of separated flow occurs on the lee side of the deflected flap of the AGM-130A while the flow over the air-to-air missile deflected elevator is attached.

DTIC

Computational Fluid Dynamics; Navier-Stokes Equation; Separated Flow; Turbulence Models; External Store Separation; F-15 Aircraft; Transonic Flow; Flaps (Control Surfaces); Free Flow

19980213308 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Wind Tunnel Testing for Drag Reduction of an Aircraft Laser Turret

Synder, Christopher H., Air Force Inst. of Tech., USA; Jun. 1998; 111p; In English

Report No.(s): AD-A346110; AFIT/GAE/ENY/98J-02; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This study investigated the use of aft-mounted fairings and splitter plates to reduce the drag of a half-scale aircraft laser turret. Forces, moments, and pressure distributions were measured in the AFIT 1.5-m (5-ft) wind tunnel at Reynolds numbers between 3×10^5 to the 5th power and 9×10^5 to the 5th power based on the turret diameter. Oil traces indicated the nature of the flow near the surface of the unmodified turret and the surrounding area. Tufts placed on the turret, fairings, and splitter plates showed changes in separation regions when configurations were changed. The flow around the turret was characterized by dominant vortices shedding from the top of the turret and a large trailing wake of vorticity. Splitter plates were ineffective in reducing drag as a result of the strong flow over the top of the turret. A small fairing reduced baseline drag by 49% but was unable to produce attached flow near the turret. A large fairing eliminated nearly all separation regions and reduced baseline drag by 55%.

DTIC

Wind Tunnel Tests; Drag Reduction; Lasers; Fairings; Afterbodies

03

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19980211010 General Accounting Office, Washington, DC USA

Airline Competition: Cargo Airline Has Enhanced Competition in Hawaii but Faces an Uncertain Future

Jun. 18, 1998; 25p; In English

Report No.(s): AD-A348183; GAO/RCED-98-156; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Because Hawaii comprises eight major islands remote from the U.S. mainland, many cargo customers must rely on air service as the only way to transport their goods in a timely fashion. Historically, two airlines have provided service to meet this need. Under an exemption from provisions of the Airport Noise and Capacity Act, these two airlines are permitted to operate an interisland "turnaround" service (i.e., flights within Hawaii) with relatively noisy 'Stage 2' aircraft, which are being phased out on the mainland. Specifically, airlines that were providing turnaround service with Stage 2 aircraft when the act was passed in November 1990 are allowed to continue to do so. In May 1995, the Federal Aviation Administration (FAA) determined that American International Cargo (AIC) also qualified on the basis of its November 1990 operations, in which it provided what FAA deemed turnaround service in Hawaii - and "onward" service to the U.S. mainland - with a McDonnell-Douglas DC-5 Stage 2 aircraft. In November 1995, this airline began to conduct scheduled interisland cargo service consistent with FAA's decision. Shortly thereafter, in a reinterpretation of its 1995 decision, FAA concluded that AIC did not qualify to continue providing such service. FAA's revised interpretation required AIC either to begin operating quieter, Stage 3, aircraft on interisland routes or to exit these markets entirely.

Converting an aircraft for Stage 3 operations typically costs an airline \$1.5 million per engine. Legislation enacted in Oct 1996 allowed AIC to continue serving Hawaii's interisland markets with one Stage 2 aircraft through September 30, 1998. To help prepare the Congress to reexamine the issue as the deadline approaches, you asked us to determine on what basis FAA revised its interpretation of turnaround service.

DTIC

Hawaii; Airline Operations; Noise Pollution; Aircraft Noise; Commercial Aircraft

19980211011 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
The Air Operations Simulation Centre Audio System

World, Reg, Defence Science and Technology Organisation, Australia; Apr. 1998; 44p; In English

Report No.(s): AD-A348181; DSTO-GD-0172; DODA-AR-010-512; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Air Operations Division at the Aeronautical and Maritime Research Laboratory has established the Air Operations Simulation Centre for conduct of manned aircraft flight simulations. An audio system has been developed to deliver sound effects during simulations and to provide audio communications between manned stations. This report describes the hardware and software components of the audio system.

DTIC

Aircraft; Flight Simulation

19980214896 General Accounting Office, Washington, DC USA

Testimony Before the Subcommittee on Aviation, Committee on Commerce, Science and Transportation, US Senate. Aviation Competition: Proposed Domestic Airline Alliances Raise Serious Issues

Jun. 04, 1998; 22p; In English

Report No.(s): AD-A349433; GAO/T-RCED-98-215; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Six major domestic airlines have proposed alliances in 1998. These alliances are significant in scope but vary in extent, and their details are still emerging. In sum, the three alliances would control about 70 percent of domestic traffic, as measured by the number of passengers that board a plane-enplanements. Table 1 summarizes the size and characteristics of the proposed alliances. A key characteristic of two of the alliances is extensive code-sharing. According to officials at DOJ and DOT, code-sharing agreements are forms of corporate integration that fall between outright mergers, which involve equity ownership, and traditional arm's length agreements between airlines about such things as how they will handle tickets and baggage.

DTIC

Competition; Congressional Reports; Commercial Aircraft; Civil Aviation

19980214901 Air Force Academy, CO USA

USAFA Discovery, Jul - Sep. 1998

Jan. 1998; 8p; In English

Report No.(s): AD-A349467; USAFA-98-03; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

USAFA Discovery is published quarterly by the faculty of the U.S. Air Force Academy (USAFA). It contains reports on USAFA cadet and faculty research, a complete list of current USAFA research points of contact, and a summary of recent awards and publications. Partial contents include: A Bird Avoidance Model for the US Air Force; Aeronautical Research Center Leading Effort to Improve Operational Capability of AC-130U Gunship; and overviews of The Institute for National Security Studies and The Institute for Information Technology Applications.

DTIC

Research Facilities; Technology Utilization; Security; Armed Forces; Bird-Aircraft Collisions

04

AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19980211057 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

New Algorithms for Moving-Bank Multiple Model Adaptive Estimation

Vasquez, Juan R., Air Force Inst. of Tech., USA; May 26, 1998; 325p; In English

Report No.(s): AD-A347840; AFIT/DS/ENG/98-10; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

The focus of this research is to provide methods for generating precise parameter estimates in the face of potentially significant parameter variations such as system component failures. The standard Multiple Model Adaptive Estimation (MMAE) algorithm uses a bank of Kalman filters, each based on a different model of the system. A new moving-bank MMAE algorithm is developed based on exploitation of the density data available from the MMAE. The methods used to exploit this information include various measures of the density data and a decision-making logic used to move, expand, and contract the MMAE bank of filters. Parameter discretization within the MMAE refers to selection of the parameter values assumed by the elemental Kalman filters. A new parameter discretization method is developed based on the probabilities associated with the generalized Chi-Squared random variables formed by residual information from the elemental Kalman filters within the MMAE. Modifications to an existing discretization method are also presented, permitting application of this method in real time and to nonlinear system models or linear/linearized models that are unstable or a stable. These new algorithms are validated through computer simulation of an aircraft navigation system subjected to interference/jamming while attempting a successful precision landing of the aircraft.

DTIC

Algorithms; Systems Analysis; Procedures; Estimates; Computerized Simulation; Random Variables; Probability Theory

19980213306 Radex, Inc., Bedford, MA USA

GPS Scintillation Analysis

Caton, Ronald G., Radex, Inc., USA; Kendra, Michael J., Radex, Inc., USA; McNell, William J., Radex, Inc., USA; Jan. 15, 1998; 34p; In English

Contract(s)/Grant(s): F19629-95-C-0106; AF Proj. 7659

Report No.(s): AD-A346074; RXR-980101; AFRL-VS-HA-TR-98-0013; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Scintillation data recorded by Global Positioning System (GPS) receivers in various locations are examined. This report details our investigation into the validation of the GPS S4 and 60-second phase sigma values for their inclusion into the Air Force Research Laboratory Scintillation Network Decision Aid (SCINDA) as an aid in issuing scintillation warnings and predictions. GOES8 L-band data is compared with GPS S4 and phase sigma levels during moderate scintillation. The construction of and need for site specific masks to reduce the possibility of issuing false scintillation warnings due to persistent anomalous spikes seen in the GPS data, likely due to interference, is also discussed.

DTIC

Global Positioning System; Scintillation

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19980210899 Naval Research Lab., Washington, DC USA

The Path to Affordable Long Term Failure Warning: The XRF-Wear Monitor

Whitlock, Robert R., Naval Research Lab., USA; Humphrey, Gary R., Joint Oil Analysis Program, USA; Churchill, Darrell B., GasTOPS Ltd., Canada; Jan. 1998; 10p; In English; Prepared in collaboration with Joint Oil Analysis Program Technical Support Center, Pensacola, FL and GasTOPS Ltd., Onatario, Canada.

Report No.(s): AD-A348000; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Long term early warning of wear related failure has recently been demonstrated for operational turbine engines. Particles recovered from Navy F/A-18 engine oil filters were analyzed for chemical elemental content using X-ray fluorescence analysis (XRF). (1) The data were compared with known engine metallurgy to determine the source of particles generated by wear, corrosion, and contamination. The identified sources agreed with engine history as recorded in the maintenance database. Normally

operating engines showed low levels of wear particulates, as expected. The XRF filter debris analysis method (XRF-FDA) successfully identified every oil wetted wear-related failure as having elevated quantities of metals. Warning times in excess of 100 operating hours; and (2) were achieved through the ability of XRF to measure elements other than iron. Some engines undergoing high time replacements showed high levels of metals as expected; the method enables the low wear engines to be identified. These striking results have implications for planning of operations and maintenance. This paper presents the XRF-Wear concept for autonomous on-line monitoring of aviation engines and other high value machinery. An economically advantageous approach to assembling the wear-profile database of previously unmonitored equipment is offered in the context of a fully automated, field deployable, on-site expert system.

DTIC

Corrosion; Turbine Engines; Early Warning Systems; Contamination; Turbines; Aircraft Engines; Failure

19980211055 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Melbourne, Australia
An Investigation of F/A-18 AMAD Gearbox Driveshaft Vibration

Rebbechi, Brian, Defence Science and Technology Organisation, Australia; Burchill, Madeleine, Defence Science and Technology Organisation, Australia; Coco, Gareth, Defence Science and Technology Organisation, Australia; Nov. 1997; 101p; In English

Report No.(s): AD-A348040; DSTO-TN-0121; DODA-AR-010-389; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The RAAF has experienced several failures of the input bearing of the F/A-18 AMAD (Aircraft Mounted Accessory Drive) gearbox. Two of these failures have resulted in in-flight fires. Measurements of input housing vibration showed very high vibration levels on some aircraft, apparently due to unbalance in the driveshaft assembly. Subsequent measurement of drive-shaft motion confirmed synchronous forward whirl of the driveshaft. The driveshaft system appears to operate below its first critical speed, but there are indications that the first critical speed may not be far above running speed. There is no evidence of significant drive-shaft system resonances during the operating speed range of idle to full military power. The unbalance appears to result primarily from clearances in the AMAD gearbox input shaft assembly. These clearances will bring about an initial unbalance of the assembly much greater than specified component tolerances. Partial alleviation of the high vibration has been brought about by rotation of the 19E215-1 driveshaft relative to the input power take-off shaft assembly.

DTIC

Vibration; Failure; Aircraft; Transmissions (Machine Elements)

19980211413 DME Corp., Fort Lauderdale, FL USA

Automated Machinery Health Monitoring Using Stress Wave Analysis and Artificial Intelligence

Board, David B., DME Corp., USA; Jan. 1998; 10p; In English

Report No.(s): AD-A347198; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes the current state of development of a prototype mechanical diagnostic system for the U.S. Army, for application to helicopter drive train components. The system will detect structure borne, high frequency acoustic data, and process it with feature extraction and polynomial network artificial intelligence software. Data for network training and evaluation has been acquired from both healthy and discrepant components, operated over a full range of loads, in a test cell. Stress Wave Analysis is a high frequency acoustic sensing and signal conditioning technology, which provides an analog signal that is a time history of friction and shock events in a machine. This Stress Wave Pulse Train (SWPT) is independent of background levels of vibration and audible noise. The SWPT is digitized and used to compute a set features that characterize the friction signature. Fault Detection Networks of polynomial equations are used to automatically classify SWPT features as being representative of either healthy or discrepant mechanical components. The application of these techniques for automatic classification of friction signatures advances current technology to achieve real time diagnostic capability at all flight power levels.

DTIC

Health; Data Recorders; Prototypes; Diagnosis; Acoustic Properties; Evaluation; Data Acquisition

19980214900 Dayton Univ. Research Inst., OH USA

The Effects of the Cold Working Process and Interference Fit Bushings on the Fatigue Life of Polycarbonate Specimens with Holes *Interim Report, Nov. 1994 - Apr. 1997*

Huelsman, Marc A., Dayton Univ. Research Inst., USA; Bowman, Daniel R., Dayton Univ. Research Inst., USA; Apr. 1997; 36p; In English

Contract(s)/Grant(s): F33615-92-C-3400; AF Proj. 2402

Report No.(s): AD-A349453; UDR-TR-97-71; WL-TR-97-3110; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aircraft transparencies must provide performance and durability at an acceptable cost to be considered for production. The most important performance factor is flight safety. In order to achieve flight safety from a structural standpoint, the transparency system must withstand loads associated with flight and with bird impact. Conventional transparencies are fastened to an aircraft using bolts, and the ability to withstand flight loads or bird impact is strongly dependent upon the condition of the bolt holes in the transparency. Fatigue loading results from flight, and transparencies are subject to cracking due to the stress concentration associated with the bolt holes. Bolt hole cracks have been found by inspecting service-aged F-111, F-16, and B-1 transparencies. Transparency bolt hole cracking results in a reduced life of the transparency as well as reduced birdstrike capability. Because of the problems associated with bolt hole cracking: improvements in the fatigue life of the transparency will reduce the number of transparencies that are removed for this cause. Also, since many aircraft transparencies are now refurbished one or more times, reducing or eliminating bolt hole cracking will increase the refurbishable life of aircraft transparencies. In addition, birdstrike protection will not be reduced. This program was conducted to investigate and refine cold working techniques and to investigate interference fit bushings. Results of this program show better than two orders of magnitude improved fatigue life with interference fit bushings over the baseline.

DTIC

Polycarbonates; Bolts; Bushings; Cold Working; Fatigue Life; Aircraft Maintenance

06

AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

19980211410 Naval Research Lab., Marine Geosciences Div., Stennis Space Center, MS USA

AV-8B Map System 2: Moving Map Composer Software Users Manual *Final Report*

Lohrenz, Maura C., Naval Research Lab., USA; Gendron, Marlin L., Naval Research Lab., USA; Mehaffey, J. Michelle, Naval Research Lab., USA; Wischow, Perry B., Naval Research Lab., USA; Trenchard, Michael E., Naval Research Lab., USA; May 27, 1998; 73p; In English

Report No.(s): AD-A347231; NRL/FR/7441--97-9677; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report documents the Moving Map Composer (MMC) software system developed by scientists in NRL Code 7441. The MMC software is resident on the AV-8B Map 2 Station, which NRL designed and configured in support of AV-8B mission planners and pilots in the field. These MMC driven Map 2 Stations enable AV-8B users to perform the following functions: (1) Design and build Aircraft Optical Disk (AOD) images from user specified Compressed Aeronautical Chart (CAC) and scanned chart data; (2) Include emergency check lists and reconnaissance photographs in an AOD image; (3) Write completed AOD images to militarized Write Once Read Many AODs; (4) Evaluate failed AODs and recover from failed AOD image builds; (5) Design and build Mission Planning System Compact Disk Images (MPS CDIs) from user specified CAC, scanned chart, and DTED data; (6) Write MPS CDIs to Recordable Compact Disk (CD-R) for mission planning purposes; and (7) Scan and compress paper charts into a CAC compatible format (when CAC or Arc Digitized Raster Graphics (ADRG) are not available) and include them in an AOD image or MPS-CDI. These Map 2 Stations will completely replace all map data functions and all optical disk image functions that are currently handled by the AV-8B Map, Operator, and Maintenance Stations (MOMS).

DTIC

Maps; Computer Programs; Computer Aided Design; Evaluation; User Manuals (Computer Programs); Digital Data; Navigation Aids; Computer Graphics; Charts

07

AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19980211303 NASA Lewis Research Center, Cleveland, OH USA

Wave Augmented Diffusers for Centrifugal Compressors

Paxson, Daniel E., NASA Lewis Research Center, USA; Skoch, Gary J., Army Research Lab., USA; Jul. 1998; 10p; In English; 34th; Propulsion, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA Contract(s)/Grant(s): RTOP 523-26-33

Report No.(s): NASA/TM-1998-208480; E-11253; NAS 1.15:208480; AIAA Paper 98-3401; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A conceptual device is introduced which would utilize unsteady wave motion to slow and turn flows in the diffuser section of a centrifugal compressor. The envisioned device would substantially reduce the size of conventional centrifugal diffusers by eliminating the relatively large ninety degree bend needed to turn the flow from the radial/tangential to the axial direction. The bend would be replaced by a wall and the flow would instead exit through a series of rotating ports located on a disk, adjacent to the diffuser hub, and fixed to the impeller shaft. The ports would generate both expansion and compression waves which would rapidly transition from the hub/shroud (axial) direction to the radial/tangential direction. The waves would in turn induce radial/tangential and axial flow. This paper presents a detailed description of the device. Simplified cycle analysis and performance results are presented which were obtained using a time accurate, quasi-one-dimensional CFD code with models for turning, port flow conditions, and losses due to wall shear stress. The results indicate that a periodic wave system can be established which yields diffuser performance comparable to a conventional diffuser. Discussion concerning feasibility, accuracy, and integration follow.

Author

Centrifugal Compressors; Centrifugal Force; Compression Waves; Elastic Waves; Computational Fluid Dynamics

19980211424 Air Force Research Lab., Wright-Patterson AFB, OH USA

The Future Direction and Development of Engine Health Monitoring (EHM) Within the USA Air Force

Green, Andrew J., Air Force Research Lab., USA; Apr. 24, 1998; 7p; In English; Paper from the 1998 Technology Showcase Joap International Condition Monitoring Conference.

Report No.(s): AD-A347976; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The USAF has set itself goals for capability, performance and reliability standards that it must achieve if it is to maintain air superiority. The advent of novel design methodologies and materials has put the spotlight on engine diagnostics and prognostics as an essential element to achieve those goals. The development and implementation of the COEHM Methodology will help meet the set Autonomics goals and the needs of the third millennium. The development of a totally sensed engine (real or virtual) that provides exact and accurate data will help a COEHM system perform the AI function that is required to derive fast and accurate answers; this will enable the maintainers to quickly regenerate an aircraft for its next mission. The COEHM is more than just an approach but an asserted effort to produce a range of compatible EM systems for 2001 and beyond.

DTIC

Gas Turbines; Engines; Health; Autonomy

19980211443 NASA Lewis Research Center, Cleveland, OH USA

Model Engine Performance Measurement From Force Balance Instrumentation

Jeracki, Robert J., NASA Lewis Research Center, USA; Jul. 1998; 30p; In English; 34th; Propulsion, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 538-03-11

Report No.(s): NASA/TM-1998-208486; E-11263; NAS 1.15:208486; AIAA Paper 98-3112; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A large scale model representative of a low-noise, high bypass ratio turbofan engine was tested for acoustics and performance in the NASA Lewis 9- by 15-Foot Low-Speed Wind Tunnel. This test was part of NASA's continuing Advanced Subsonic Technology Noise Reduction Program. The low tip speed fan, nacelle, and an un-powered core passage (with core inlet guide vanes) were simulated. The fan blades and hub are mounted on a rotating thrust and torque balance. The nacelle, bypass duct stators, and core passage are attached to a six component force balance. The two balance forces, when corrected for internal pressure tares, measure the total thrust-minus-drag of the engine simulator. Corrected for scaling and other effects, it is basically the same force that the engine supports would feel, operating at similar conditions. A control volume is shown and discussed, identifying the various force components of the engine simulator thrust and definitions of net thrust. Several wind tunnel runs with nearly the same hardware installed are compared, to identify the repeatability of the measured thrust-minus-drag. Other wind tunnel runs, with hardware changes that affected fan performance, are compared to the baseline configuration, and the thrust and torque effects are shown. Finally, a thrust comparison between the force balance and nozzle gross thrust methods is shown, and both yield very similar results.

Author

Ducted Fans; Thrust; Aerodynamic Drag; Wind Tunnels; Fan Blades; Turbofan Engines

19980211493 NASA Lewis Research Center, Cleveland, OH USA

High Stability Engine Control (HISTEC) Flight Test Results

Southwick, Robert D., Pratt and Whitney Aircraft, USA; Gallops, George W., Pratt and Whitney Aircraft, USA; Kerr, Laura J., Pratt and Whitney Aircraft, USA; Kielb, Robert P., Pratt and Whitney Aircraft, USA; Welsh, Mark G., Pratt and Whitney Aircraft, USA; DeLaat, John C., NASA Lewis Research Center, USA; Orme, John S., NASA Dryden Flight Research Center, USA; Jul. 1998; 12p; In English; 34th; Propulsion, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 523-53-13

Report No.(s): NASA/TM-1998-208481; E-11255; NAS 1.15:208481; AIAA Paper 98-3757; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The High Stability Engine Control (HISTEC) Program, managed and funded by the NASA Lewis Research Center, is a cooperative effort between NASA and Pratt & Whitney (P&W). The program objective is to develop and flight demonstrate an advanced high stability integrated engine control system that uses real-time, measurement-based estimation of inlet pressure distortion to enhance engine stability. Flight testing was performed using the NASA Advanced Controls Technologies for Integrated Vehicles (ACTIVE) F-15 aircraft at the NASA Dryden Flight Research Center. The flight test configuration, details of the research objectives, and the flight test matrix to achieve those objectives are presented. Flight test results are discussed that show the design approach can accurately estimate distortion and perform real-time control actions for engine accommodation.

Author

Engine Control; F-15 Aircraft; Flight Tests; Aircraft Engines; Flow Distortion; Thrust Control

08

AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19980211108 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

High Amplitude Tracking Control

McNamee, Joseph W., Air Force Inst. of Tech., USA; Jun. 1998; 206p; In English

Report No.(s): AD-A347638; AFIT/DS/ENG/98-09; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

The problem of tracking control in the face of high amplitude dynamic reference signals, hard state and control constraints, and open-loop unstable plants is investigated. Saturation effects mitigation is a current research topic, and a large body of literature exists which addresses this problem. However, with a few notable exceptions, little work has been accomplished which is applicable to the problem of high amplitude dynamic reference signal tracking in the face of hard state and control constraints, and open-loop unstable plants. Moreover, methods that do address the stated problem generally limit the exogenous reference signal to statically admissible values to obtain a BIBO stable closed-loop system. In these investigations a nonlinear reference signal governor generates a modified reference signal based on the exogenous reference signal and the state of the controlled process. This research departs from previous work in that a dual-loop reference signal governor methodology is developed that prevents constraint violation but does not restrict the modified reference signal to statically admissible values. Thus tracking performance is improved. An arbitrarily close approximation of the controlled process maximal statically admissible set is characterized. On-line computational burden is generally less than that imposed by current reference signal governor methods, and the resulting closed-loop system is BIBO stable.

DTIC

Speed Regulators; Feedback Control; Amplitudes; Control Systems Design; Tracking (Position)

19980211327 NASA Langley Research Center, Hampton, VA USA

Parameter Estimation of Actuators for Benchmark Active Control Technology (BACT) Wind Tunnel Model with Analysis of Wear and Aerodynamic Loading Effects

Waszak, Martin R., NASA Langley Research Center, USA; Fung, Jimmy, NASA Langley Research Center, USA; Jul. 1998; 32p; In English; Atmospheric Flight Mechanics Conference, 29-31 Jul. 1996, San Diego, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): RTOP 505-64-52-01

Report No.(s): NASA/TM-1998-208452; NAS 1.15:208452; L-17540; AIAA Paper 96-3362; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the development of transfer function models for the trailing-edge and upper and lower spoiler actuators of the Benchmark Active Control Technology (BACT) wind tunnel model for application to control system analysis and design. A simple nonlinear least-squares parameter estimation approach is applied to determine transfer function parameters from frequency response data. Unconstrained quasi-Newton minimization of weighted frequency response error was employed to estimate the transfer function parameters. An analysis of the behavior of the actuators over time to assess the effects of wear and aerodynamic load by using the transfer function models is also presented. The frequency responses indicate consistent actuator behavior throughout the wind tunnel test and only slight degradation in effectiveness due to aerodynamic hinge loading. The resulting actuator models have been used in design, analysis, and simulation of controllers for the BACT to successfully suppress flutter over a wide range of conditions.

Author

Actuators; Control Systems Design; Transfer Functions; Active Control; Aerodynamic Loads

09

RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19980211052 Army Cold Regions Research and Engineering Lab., Hanover, NH USA

Construction, Maintenance, and Operation of a Glacial Runway, McMurdo Station, Antarctica

Blaisdell, George L., Army Cold Regions Research and Engineering Lab., USA; Lang, Renee M., Army Cold Regions Research and Engineering Lab., USA; Crist, Gerald, Army Cold Regions Research and Engineering Lab., USA; Kurtti, Keith, Army Cold Regions Research and Engineering Lab., USA; Harbin, R. J., Army Cold Regions Research and Engineering Lab., USA; Mar. 1998; 138p; In English

Report No.(s): AD-A348091; CRREL-98-1; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

On 7 February 1994, a C-141 departed Christchurch, New Zealand, and landed on the 3050 m (10,000 ft) Pegasus glacial ice runway, located on the Ross Ice Shelf 13 km (8 miles) south of McMurdo, Antarctica. This event marked the final test for a five-year development program to demonstrate the feasibility of a semipermanent glacial ice runway capable of supporting heavy wheeled aircraft at a site easily accessible to McMurdo. In the later phases of developing the glacial ice runway, numerous working flights of LC-130s operating on wheels (rather than skis) moved cargo more efficiently to the South Pole, and the LC-130 and a C-130 carried larger passenger loads to Christchurch. The primary benefit of the Pegasus runway to the US Antarctic Program is its ability to support heavy wheeled aircraft for most of the period of mid-January through November. In the past, only ski-equipped aircraft could land in the McMurdo area during this time period. The Pegasus runway allows increased payloads for the LC-130 (an additional 3600 kg or 8000 lb takeoff weight when using wheels) and provides access for virtually any conventional aircraft. The technology for siting, constructing, maintaining, and operating such a runway is now well understood and is described in detail in this comprehensive report.

DTIC

Runways; Glaciers; C-141 Aircraft; Construction; McMurdo Sound

19980211422 Naval Facilities Engineering Service Center, Port Hueneme, CA USA

Thermochemical Concrete Pavement Scaling Mechanism: Navy F/A-18 Jet Aircraft Parking Apron Problem *Final Report, 1994-1998*

Novinson, Thomas, Naval Facilities Engineering Service Center, USA; Jun. 1998; 33p; In English

Report No.(s): AD-A347038; NFESC-TM-2281-SHR; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Experiments were conducted to determine the mechanism of concrete "scaling" or deterioration on airfield parking aprons used by F/A-18 Navy jets. Some of the "scaling" was caused by heat from the auxiliary power unit (APU) and some was caused by phosphoric acid attack on the heated concrete. The phosphoric acid originated from hydrolysis of organic phosphates in used engine oil. The mechanism was confirmed by demonstrating that the concrete scale debris was high in phosphate content.

DTIC

Thermal Degradation; Chemical Attack; Pavements; Experimentation; Deterioration; Concretes; Landing Sites

19980211576 NYMA, Inc., Brook Park, OH USA

Subsonic Flow Quality Surveys of the NASA Lewis Research Center 10- by 10-Foot Supersonic Wind Tunnel Final Report

Arrington, E. Allen, NYMA, Inc., USA; Gonsalez, Jose C., NYMA, Inc., USA; Jun. 1998; 34p; In English

Contract(s)/Grant(s): NAS3-27186; RTOP 505-62-82

Report No.(s): NASA/CR-1997-206326; NAS 1.26:206326; E-11017; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

During April 1996, qualification tests for the subsonic operation of the 10- by 10-Foot Supersonic Wind Tunnel (10 x 10 SWT) were conducted. These tests proved that the facility could be safely operated over the subsonic Mach number range of 0 to 0.36 either by using the air circulation fans of the facility air dryer or by operating the primary drive compressor with one, two, three or all four of the electric drive motors. During the qualification tests, an existing flow field survey rake was used to collect total and static pressure data in the test section. This rake was used for all the surveys made at the operating conditions tested during the qualification tests. The data showed that the spanwise Mach number distribution at the test section centerline was acceptable and that the goal of 0.005 variation in Mach number was met for most of the subsonic operating conditions.

Author

Test Chambers; Supersonic Wind Tunnels; Surveys; Performance Tests

11

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19980211103 Academy of Sciences (USSR), Applied Physics Inst., Irkutsk, USSR

Scintillation Method of Analysis for Determination of Properties of Wear Particles in Lubricating Oils

Skudae, Yuri D., Academy of Sciences (USSR), USSR; Alkhimov, Andrey B., Academy of Sciences (USSR), USSR; Drovov, Victor G., Academy of Sciences (USSR), USSR; Zarubin, Valentin P., Academy of Sciences (USSR), USSR; Kazmirov, Alexandr P., Academy of Sciences (USSR), USSR; Jan. 1998; 16p; In English

Report No.(s): AD-A347665; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Nowadays there is a demand for effective methods and equipment for early detection of failures of aircraft engines. The spectral diagnostics methods used in Russian civil aviation have a low information capacity and poor metrological features and they can not be used for reliable prognosis of the engine serviceability. Applied Physics Institute of Irkutsk State University (Russia) together with Joint-Stock Company 'Baikal Airlines' have elaborated the scintillation method of analysis of lubricating oils for wear products. It enables to obtain quickly and with high accuracy the information on: (1) a metal wear particles content, (2) a dissolved metal content, (3) an amount of wear particles, (4) an amount of simple particles, (5) an amount of complex particles, and (6) a composition of each particle. The exact determination of wear particle composition (including micron-sized particles of Fe-Cu, Fe-Ni, Fe-Ag) permits to pursue the unit-to-unit diagnostics of aircraft engines. In addition to the civil aviation the scintillation method is applicable for diagnostics of an equipments in airforce, a navy, a petroleum and engineering industries, in automobile, railway and sea transport and other engines and machines. Besides, this method may be useful for tribological investigation of a quality of lubricant materials, in the development of new lubricants.

DTIC

Wear Resistance; Lubricating Oils; Technology Assessment; Aircraft Engines; Commercial Aircraft; Diagnosis; Failure

19980211490 Computational Systems, Inc., Knoxville, TN USA

The Application of Time Resolved Dielectric Instruments to Air Force Ground Fleet Maintenance

Thompson, Stephanie, Computational Systems, Inc., USA; 1998; 5p; In English

Report No.(s): AD-A347346; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

In 1993 the Military Equipment Evaluation Program (MEEP) located at Eglin Air Force Base, FL, evaluated a time resolved dielectric instrument for use in air force ground fleet maintenance applications. They identified this instrument as a useful device for what they termed bumper testing intended to measure oil quality before changing oil rather than simply changing oil based on calendar months or equipment usage (miles or hours). Since that time the instrument has been accepted and is in use at many US Air Force installations world wide. Typically an air base will have approximately 40 ground vehicles for every one flight vehicle. For example, Eglin has approximately 1200 ground vehicles supporting 30 fighting aircraft. The aircraft get oil analysis done very frequently. Until the time resolved dielectric instrument was made available, no oil analysis was performed on the

ground fleet. This paper describes the application, use and results achieved by using a multifunctional oil analyzer in the maintenance shops to determine oil conditions before taking maintenance actions.

DTIC

Lubricating Oils; Aircraft Maintenance; Dielectrics

19980211556 General Electric Co., Corporate Research and Development Center, Schenectady, NY USA

Electron beam physical vapor deposition through tungsten

Corderman, R., General Electric Co., USA; Dobbs, J., General Electric Co., USA; Dupree, P., Department of Energy, USA; Oct. 17, 1997; 194p; In English

Contract(s)/Grant(s): DE-FG02-94ER-12142

Report No.(s): DOE/ER/12142-T1; DE98-005129; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

High temperature alloys for application to power generation and aircraft engine gas turbine components are presently at their performance limits. New alloys that use intermetallic matrix composites (IMCs) offer a path to higher efficiency engines. Cost-effective synthesis of these revolutionary materials will depend on the development of more efficient processing techniques. Electron beam physical vapor deposition (EB-PVD), enhanced by refractory element addition, offers a key to both increased deposition rate and composition control for these demanding new materials. Initial results with tungsten-assisted EB-PVD had been so dramatic that it became important to investigate the mechanism of this process and to determine the ease with which it could be implemented in EB-PVD machines of different design. The research presented in this report investigates the effects of refractory metal addition on electron beam physical vapor deposition (EB-PVD) of Ni-base alloys containing Co, Cr and Al. Experiments were conducted in which W, Nb, Ta, Mo, or Re was added to pure Ni or Ni-base alloy evaporation pools to study the effects that the various refractory elements had on evaporation rate and the composition control of the deposit. These experiments employed three distinctly different sets of evaporation equipment, so that the effects of processing variables could also be examined. Deposit compositions, deposition rates, and evaporation pool compositions were evaluated in order to determine the effects of refractory addition on the evaporation process. The relationship between deposit properties such as deposition rate, chemistry, and microstructure, and processing parameters such as applied power, electron beam pattern frequency, beam focus, and height of the liquid pool in the crucible were also investigated.

DOE

Electron Beams; Vapor Deposition; Tungsten; Heat Resistant Alloys; Aircraft Engines; Evaporation; Gas Turbine Engines

19980211605 Royal Melbourne Inst. of Tech., Sir Lawrence Wackett Centre for Aerospace Design Technology, Australia

Non-Linear Rate-dependant Behaviour of Aerospace Graphite-Epoxy Laminates

Ohler, B., Technische Hochschule, Germany; Alesi, H., Royal Melbourne Inst. of Tech., Australia; Jones, R., Defence Science and Technology Organisation, Australia; Feb. 1993; 118p; In English

Report No.(s): RMIT-TR-93/01; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche; US Sales Only; US Sales Only

This report is related to one aspect of structural weight savings. In the early days of aviation, wood and linen were the main material for the construction of aeroplanes. Later, with progress in technology, aluminium was introduced. Today, it seems that aircraft design using aluminium has reached its limits concerning weight-saving possibilities. This is not so for composite materials which have been used in aerospace engineering over the past 15 to 20 years. At first, only for the construction of small aircraft, preferably gliders, and secondary structural parts such as cargo and undercarriage doors and, later, even for primary structural parts like the fin of the AIRBUS 320. The aim for the future is to extend the use of composite materials to other primary structural parts of an airplane such as wing and fuselage. In the future, it could be possible to build an airliner entirely of composites. There are already some examples of smaller planes (BEECH STARSHIP, DORNIER SEASTAR) where the feasibility of this concept is validated. This work is connected with postbuckling of stiffened composite panels. Aluminium panels are allowed to buckle because the behaviour of the material is known and wide experience exists in using metal for buckling and postbuckling load cases. Composite materials are so far not allowed to buckle because it was assumed that they fail when buckling. If it can be proven that composites do not fail due to a buckling load, it will be of interest to predict their postbuckling behaviour. The aim of this project is to determine a shear stress-shear strain relation for a particular aerospace graphite-epoxy laminate and numerically simulating using the finite element software packages.

Derived from text

Graphite-Epoxy Composites; Weight Reduction; Aircraft Design; Aluminum; Applications Programs (Computers); Composite Structures; Finite Element Method; Stress-Strain Relationships; Structural Weight

12 ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19980211357 Technische Univ., Berlin, Germany

Blades and disks in gas turbines. Material and component behaviour: Project department D *Final Report Schaufeln und Scheiben in Gasturbinen. Werkstoff- und Bauteilverhalten: Projektbereich D. Abschlussbericht*

Apr. 1997; 461p; In German

Report No.(s): ETDE-DE-655; DE98-743145; No Copyright; Avail: Issuing Activity (Nat'l Technical Information Service (NTIS)); US Sales Only, Microfiche

The Special Research Department No. 339, "Disks and Blades in Gas Turbines - Material and Component Characteristics" received financial support from 1988 through 1996. This final report discusses activities of the years 1994, 1995, and 1996. Project group D, "Production and Quality Assurance", investigated rotors and blades. Grinding techniques were developed and optimized for nickel base materials, and the effects of grinding on the marginal zones was investigated, including an analysis of intrinsic stresses induced by machining. In the field of ceramics, separation and production of reinforced ceramics was investigated, and techniques for vacuum soldering of ceramic/ceramic and ceramic/metal compounds for high-temperature applications were developed. In the framework of a part-project carried out at HMI, neutron diffraction was used for nondestructive analysis of volume intrinsic stresses near the joint both on model geometries and on the joint between metal shaft and ceramic rotor. The development and application of computerized tomography for testing of ceramic rotors and joints was an important contribution to quality assurance.

DOE

Ceramics; Gas Turbines; Quality Control; Disks (Shapes); Composite Materials; Rotors; Heat Resistant Alloys; Manufacturing; Turbine Blades

19980211463 NASA Marshall Space Flight Center, Huntsville, AL USA

A Case Study for Probabilistic Methods Validation (MSFC Center Director's Discretionary Fund, Project No. 94-26) *Final Report*

Price J. M., NASA Marshall Space Flight Center, USA; Ortega, R., NASA Marshall Space Flight Center, USA; Jul. 1998; 24p; In English

Report No.(s): NASA/TM-1998-208529; NAS 1.15:208529; M-878; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Probabilistic method is not a universally accepted approach for the design and analysis of aerospace structures. The validity of this approach must be demonstrated to encourage its acceptance as it viable design and analysis tool to estimate structural reliability. The objective of this Study is to develop a well characterized finite population of similar aerospace structures that can be used to (1) validate probabilistic codes, (2) demonstrate the basic principles behind probabilistic methods, (3) formulate general guidelines for characterization of material drivers (such as elastic modulus) when limited data is available, and (4) investigate how the drivers affect the results of sensitivity analysis at the component/failure mode level.

Author

Probability Distribution Functions; Aircraft Structures; Component Reliability; Failure Modes

19980213255 California Univ., Dept. of Mechanical Aerospace and Nuclear Engineering, Los Angeles, CA USA

Conformable M3 Microsystems for Aerodynamic Control *Final Report, 15 Oct. 1993 - 31 Dec. 1997*

Chih-Ming, Ho, California Univ., USA; Yu-Chong, Tai, California Univ., USA; May 29, 1998; 30p; In English

Contract(s)/Grant(s): F49620-94-1-0008

Report No.(s): AD-A346213; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The recently emerging microelectromechanical technology has created a new frontier for the control of aerodynamic, structural and propulsion systems. The micromachining process provides two unique features for transducer technology: large in quantity and minute in size. A large number of sensors and actuators are essential for distributed system control while miniature transducers are necessary to satisfy high spatial resolution requirements. In this project, we suggest a microsystem concept which will make quantum advances to the still emerging microelectromechanical technology. The purpose is to develop a new conformable Mhat3 technology for use in active flow control on a delta wing. The Mhat3 technology will integrate microelectronics, microsensors, and microactuators on a planar silicon chip. The conformable Mhat3 technology has made another advancement

to finish the integrated transducers and electronics on a flexible skin, hence called the smart skin here. to our knowledge, there is no existing technology and no ongoing research to provide conformable Mhat3 systems. In addition, potential applications of the smart skin in defense, aerospace and medical fields are obviously whenever 3-D surfaces are encountered. The smart skin is wrapped around the 3-D leading edge of a delta wing and control all the six components of the aerodynamic forces and moments of a delta wing such that radical changes of aircraft design concept will take place.

DTIC

Electromechanical Devices; Microelectronics; Transducers; Delta Wings; Control Surfaces; Actuators; Active Control

19980214932 Pennsylvania State Univ., State College, PA USA

Model-Based Diagnostics of Gas Turbine Engine Lubrication Systems

Byington, Carl S., Pennsylvania State Univ., USA; Jan. 1998; 10p; In English

Contract(s)/Grant(s): N00014-96-1-0271

Report No.(s): AD-A347307; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objective of the current research was to develop improved methodology for diagnosing anomalies and maintaining oil lubrication systems for gas turbine engines. The effort focused on the development of reasoning modules that utilize the existing, inexpensive sensors and are applicable to on-line monitoring within the full-authority digital engine controller (FADEC) of the engine. The target application is the Enhanced TF-40B gas turbine engine that powers the Landing Craft Air Cushion (LCAC) platform. to accomplish the development of the requisite data fusion algorithms and automated reasoning for the diagnostic modules, Penn State ARL produced a generic Turbine Engine Lubrication System Simulator (TELSS) and Data Fusion Workbench (DFW). TELSS is a portable simulator code that calculates lubrication system parameters based upon one-dimensional fluid flow resistance network equations. Validation of the TF-40B modules was performed using engineering and limited test data. The simulation model was used to analyze operational data from the LCAC fleet. The TELSS, as an integral portion of the DFW, provides the capability to experiment with combinations of variables and feature vectors that characterize normal and abnormal operation of the engine lubrication system. The model-based diagnostics approach is applicable to all gas turbine engines and mechanical transmissions with similar pressure-fed lubrication systems.

DTIC

Gas Turbine Engines; Lubrication Systems; Diagnosis; On-Line Systems; Electronic Control; Fluid Flow

13 GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19980210908 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Physik der Atmosphaere, Wessling, Germany

Observations and model calculations of B747 engine exhaust products at cruise altitude and inferred initial OH emissions

Tremmel, H. G., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Schlager, H., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Konopka, P., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Schulte, P., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Arnold, F., Max-Planck-Inst. fuer Kernphysik, Germany; Klemm, M., Max-Planck-Inst. fuer Kernphysik, Germany; Droste-Franke, B., Max-Planck-Inst. fuer Kernphysik, Germany; Jun. 1997; ISSN 0943-4771; 33p; In English

Report No.(s): ETDE-DE-612; DE98-722761; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)); US Sales Only, Microfiche

NO(y) (NO, HNO₂ and HNO₃) exhaust emissions in the near-field plume of two B747 jet airliners cruising in the upper troposphere were measured in situ using the DLR Falcon research aircraft. In addition CO₂ was measured providing exhaust plume dilution rates for the species. The observations were used to estimate the initial OH concentration and NO₂/NO(x) ratio at the engine exit and the combustor exit by back calculations using a chemistry box model. From the two different plume events, and using two different model simulation modes in each case, we inferred OH emission indices EI(OH) = 0.32-0.39 g/kg fuel (OH(0) = 9-14.4 ppmv) and (NO₂/NO(x))(sub 0) = 0.12-0.17. Furthermore, our results indicate that the chemistry of the exhaust species during the short period between the combustion chamber exit and the engine exit must be considered, because OH is already consumed to a great extent in this engine section, due to conversion to HNO₂ and HNO₃. For the engines discussed here, the modeled

OH concentration between combustor exit and engine exit decreases by a factor of about 350, leading to OH concentrations of 1-2.10(exp 12) molec/cc cm at the engine exit.

DOE

Exhaust Emission; Commercial Aircraft; Plumes; Hydroxyl Emission; Exhaust Gases; Carbon Dioxide; Air Pollution

19980210988 International Energy Agency, Paris, France

IEA joint action: Aerodynamics of wind turbines

Maribo Pedersen, B., Editor; 1997; 232p; In English; 10th; Aerodynamics of Wind Turbines, 16-17 Dec. 1996, Edinburgh, UK
Report No.(s): NEI-DK-2671; CONF-961287; DE97-763238; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The advances to be made in aerodynamic prediction requires a deeper understanding of the physical processes occurring at the blades, and in the wake, of a wind turbine. This can only come from a continuing process of experimental observation and theoretical analysis. The present symposium presents the opportunity to do this by exchange of data from experiments and simulations, and by discussion of new or modified wake theories. The symposium will consists of a number of presentations by invited speakers and conclude with a summary of the talks and a round-the-table technical discussion. The talks offer the change to present behaviour from full-scale and laboratory experiments that are not explained by existing prediction codes. In addition, presentations are welcome on new modelling techniques or formulations that could make existing codes more accurate, less computationally intensive and easier to use. This symposium is intended to provide a starting point for the formulation of advanced rotor performance methods, which will improve the accuracy of load and performance prediction codes useful to the wind turbine industry.

DOE

Conferences; Aerodynamics; Vortices; Wind Turbines; Wakes; Turbine Blades; Rotors

19980211034 National Renewable Energy Lab., Golden, CO USA

Control strategy for variable-speed, stall-regulated wind turbines

Muljadi, E., National Renewable Energy Lab., USA; Pierce, K., National Renewable Energy Lab., USA; Migliore, P., National Renewable Energy Lab., USA; Apr. 1998; 6p; In English; Controls, 24-26 Jun. 1998, Philadelphia, PA, USA

Contract(s)/Grant(s): DE-AC36-83CH-10093

Report No.(s): NREL/CP-500-24311; CONF-980623; DE98-004908; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

A variable-speed, constant-pitch wind turbine was investigated to evaluate the feasibility of constraining its rotor speed and power output without the benefit of active aerodynamic control devices. A strategy was postulated to control rotational speed by specifying the demanded generator torque. by controlling rotor speed in relation to wind speed, the aerodynamic power extracted by the blades from the wind was manipulated. Specifically, the blades were caused to stall in high winds. In low and moderate winds, the demanded generator torque and the resulting rotor speed were controlled to cause the wind turbine to operate near maximum efficiency. A computational model was developed, and simulations were conducted of operation in high turbulent winds. Results indicated that rotor speed and power output were well regulated.

DOE

Control Surfaces; Wind Turbines; Active Control; Aerodynamics; Turbulence; Speed Regulators

19980211121 Sandia National Labs., Albuquerque, NM USA

Predicting aerodynamic characteristic of typical wind turbine airfoils using CFD

Wolfe, W. P., Sandia National Labs., USA; Ochs, S. S., Iowa State Univ. of Science and Technology, USA; Sep. 1997; 41p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-96-2345; DE98-000422; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

An investigation was conducted into the capabilities and accuracy of a representative computational fluid dynamics code to predict the flow field and aerodynamic characteristics of typical wind-turbine airfoils. Comparisons of the computed pressure and aerodynamic coefficients were made with wind tunnel data. This work highlights two areas in CFD that require further investigation and development in order to enable accurate numerical simulations of flow about current generation wind-turbine airfoils: transition prediction and turbulence modeling. The results show that the laminar-to turbulent transition point must be modeled

correctly to get accurate simulations for attached flow. Calculations also show that the standard turbulence model used in most commercial CFD codes, the k-e model, is not appropriate at angles of attack with flow separation.

DOE

Aerodynamic Characteristics; Performance Prediction; Wind Tunnel Tests; Airfoils; Computational Fluid Dynamics; Flow Distribution

19980211514 Technical Univ. of Denmark, Inst. for Energiteknik, Lyngby, Denmark

Basic rotor aerodynamics applied to wind turbines

Hansen, M. O. L., Technical Univ. of Denmark, Denmark; Jan. 1998; 62p; In English

Report No.(s): DTU-ET-NE-98-02; DE98-759835; ISBN 87-7475-192-1; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

It is the hope of the author that the notes will impart a basic understanding of the mechanisms behind the production of forces on a wind turbine. Even though aero-elastic codes, including a standard Blade Element Momentum method, can be bought, it is considered important that the theory behind this method and its limitations is understood. The aerodynamics of a wind turbine is important, but building a wind turbine is a multi disciplinary task since it requires knowledge of meteorology, atmospheric turbulence, fluid mechanics, structural dynamics, generators, electrical grid connections, gear boxes, hydraulics, foundations, economics and so on.

DOE

Rotor Aerodynamics; Fluid Mechanics; Atmospheric Turbulence; Dynamic Response; Aeroelasticity; Aerodynamics

19980211517 Petersen (H.) Consult, Broenshoe, Denmark

Comparison of wind turbines based on power curve analysis

Feb. 1998; 175p; In English

Contract(s)/Grant(s): ENS-51171-97.0004

Report No.(s): NEI-DK-3193; DE98-763004; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

In the study measured power curves for 46 wind turbines were analyzed with the purpose to establish the basis for a consistent comparison of the efficiency of the wind turbines. Emphasis is on wind turbines above 500 kW rated power, with power curves measured after 1994 according to international recommendations. The available power curves fulfilling these requirements were smoothened according to a procedure developed for the purpose in such a way that the smoothened power curves are equally representative as the measured curves. The resulting smoothened power curves are presented in a standardized format for the subsequent processing. Using wind turbine data from the power curve documentation the analysis results in curves for specific energy production (kWh/M(sup 2)/yr) versus specific rotor load (kW/M(sup 2)) for a range of mean wind speeds. On this basis generalized curves for specific annual energy production versus specific rotor load are established for a number of generalized wind turbine concepts. The 46 smoothened standardized power curves presented in the report, the procedure developed to establish them, and the results of the analysis based on them aim at providers of measured power curves as well as users of them including manufacturers, advisors and decision makers.

DOE

Rotors; Wind Turbines; Wind Velocity

19980213270 Department of the Navy, Washington, DC USA

Homopolar Transformer for Conversion of Electrical Energy

Smith, Robert C., Inventor, Department of the Navy, USA; Aug. 14, 1997; 10p; In English

Patent Info.: Filed 14 Aug. 1997; US-Patent-Appl-SN-911270

Report No.(s): AD-D019000; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

The DC voltage of electrical energy applied to a homopolar machine, is converted by transformer windings in response to rotor rotation within the magnetic field of the homopolar machine, to a different voltage level for supply to a load.

DTIC

Transformers; Electric Potential; Electricity; Rotors; Rotation; Homopolar Generators

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19980210921 Defence and Civil Inst. of Environmental Medicine, Downsview, Ontario Canada

Recommendations to Enhance Spatial Disorientation Training for the Canadian Forces

Cheung, Bob, Defence and Civil Inst. of Environmental Medicine, Canada; Feb. 1998; 27p; In English

Report No.(s): AD-A345707; DCIEM-98-R-32; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Spatial disorientation (SD) in flight wastes millions of dollars worth of defence capability and continues to kill aircrew. A number of CF (Canadian Forces) surveys have identified SD as the most detrimental of all listed aircraft and human factor issues in terms of its effects on flight safety and operational effectiveness. Two retrospective studies by Hartzell and Cheung et al. confirmed that SD was a significant contributing factor in 12 (between 1968-78) and 14 (between 1982-92) accidents respectively. Following a series of SD implicated mishaps in the CF-18 between 1986-90; the Commander of AIRCOM directed the initiation of ground-based disorientation training and the acquisition of an effective ground-based SD trainer. However, without a recent mishap, on-going fiscal restraint and other factors, the support and resources for acquiring an effective ground-based trainer are not available. In order to solve the SD problem, we believe that research on underlying mechanisms is productive and that hardware improvements will eventually provide substantial additional protection. Research and technological improvements that deal with SD will require a great deal of effort and money to implement and is a distant goal. For the near term, the only practical approach is to enhance SD awareness training for pilots and should be addressed without delay. This report reviews current SD training practices in the CF, and makes recommendations to enhance spatial disorientation training on the ground and in-flight. It is hoped that this report will generate continued discussions among pilots, aeromedical instructors, flight surgeons and research scientists in maintaining progress towards mounting an attack on SD.

DTIC

Disorientation; Training Devices; Flight Crews; Flight Safety; System Effectiveness; Spatial Distribution

19980213261 Air Force Operational Test and Evaluation Center, Kirtland AFB, NM USA

Advanced Aircrew Oxygen Mask Insert Evaluation Interim Report, Feb. 1996 - Jan. 1998

Liptak, Lynda, Air Force Operational Test and Evaluation Center, USA; Jun. 1998; 41p; In English

Contract(s)/Grant(s): Proj-2830

Report No.(s): AD-A349018; AFRL-HE-BR-TR-1998-0043; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Crew Technology Division of Armstrong laboratory is developing an insert for the MBU-20/P aircrew oxygen mask. The insert is placed inside the mask to enhance comfort and seal at high mask cavity pressures. The Air Force Operational Test and Evaluation Center, Rapid Test and Evaluation Directorate (AFOTEC/TA), conducted this evaluation of prototype mask inserts using Air National Guard pilots flying training sortics in F-16 aircraft. The evaluation addresses the operational use of an aircrew oxygen mask insert. The objective was to evaluate mask comfort and mask seal. A re-evaluation questionnaire was designed to assess the comfort and seal of the masks without the insert. A post-evaluation questionnaire addressed the comfort and seal of the mask with the insert. It was planned that each pilot would fly with the insert for at least two sortics. Each pilot had their original mask without insert and an unmodified mask with insert so they could swap masks between sortics and evaluate the seal and comfort of the altered mask. Pilots answered questionnaires as soon as possible after the last flights. Eighteen pilots evaluated the insert. Five pilots reported previous seal problems. All five pilots indicated the insert improved the mask seal and they would continue using the insert. However, most pilots indicated there was a problem with the comfort of the mask with the insert. There was an insufficient sample size to make a statistical determination of the mask insert improvement. Seven of 18 pilots stated they would continue to use the mask insert as it improved the mask seal. However, these pilots were split on the issue of improved comfort, and half reported that comfort decreased with the insert.

DTIC

Helmets; Oxygen Masks; Evaluation; Product Development; Aircraft Pilots

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19980210870 Odyssey Research Associates, Inc., Ithaca, NY USA

Flight Guidance System Validation Using SPIN *Final Report*

Naydich, Dimitri, Odyssey Research Associates, Inc., USA; Nowakowski, John, Odyssey Research Associates, Inc., USA; Jun. 1998; 48p; In English

Contract(s)/Grant(s): NAS1-20335; RTOP 522-33-31-01

Report No.(s): NASA/CR-1998-208434; NAS 1.26:208434; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To verify the requirements for the mode control logic of a Flight Guidance System (FGS) we applied SPIN, a widely used software package that supports the formal verification of distributed systems. These requirements, collectively called the FGS specification, were developed at Rockwell Avionics & Communications and expressed in terms of the Consortium Requirements Engineering (CoRE) method. The properties to be verified are the invariants formulated in the FGS specification, along with the standard properties of consistency and completeness. The project had two stages. First, the FGS specification and the properties to be verified were reformulated in PROMELA, the input language of SPIN. This involved a semantics issue, as some constructs of the FGS specification do not have well-defined semantics in CoRE. Then we attempted to verify the requirements' properties using the automatic model checking facilities of SPIN. Due to the large size of the state space of the FGS specification an exhaustive state space analysis with SPIN turned out to be impossible. So we used the supertrace model checking procedure of SPIN that provides for a partial analysis of the state space. During this process, we found some subtle errors in the FGS specification.

Author

Program Verification (Computers); Avionics; Control Systems Design; Computer Programs

19980214899 Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA USA

Effects of Field of View on Judgements of Self-Location: Distance Estimations Using Plainview Representations as a Function of Observer Eye Station Points (ESP) and Geometric Field of View (FOVg) *Interim Report, Aug. 1990 - Oct. 1994*

Pstotka, Joseph, Army Research Inst. for the Behavioral and Social Sciences, USA; Lewis, Sonya A., Army Research Inst. for the Behavioral and Social Sciences, USA; Jul. 1998; 30p; In English

Contract(s)/Grant(s): Proj-0611102B74F

Report No.(s): AD-A349446; ARI-RN-98-24; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The accurate location of one's (sometimes virtual) egocenter in a geometric space is of critical importance for immersion technologies. Self - location is a relatively unexplored component of size and distance estimations. This experiment was conducted to investigate the role of field of view (FOV) and observer eye station points (ESP) in the perception of the location of one's egocenter (the personal viewpoint) in virtual space. Fifty students viewed an animated 3D model, either of a similar room to the one where they sat, or of a space of round orbs of unfamiliar size, binocularly, from ESPs of either 1/2, 1, 2, 3, 4, or 5 feet. The display was on an 190 by 245 mm monitor, at a resolution of 320 by 200 pixels with 256 colors. They saw six models of both the room or orbs designed with six geometric field of view (FOVg) conditions of 18, 28, 37, 48, 86, and 140 degrees. They drew the apparent paths of the camera in each model of the room on a bitmap image of the room as seen from infinity above. The results indicate that distance perception and self - location are substantially affected by the display field of view and the computed field of view of the synthetic environment. The errors in self - location may underlie the widespread findings of underestimation of distances in virtual worlds and computer - generated imagery. They may also contribute to a better understanding of the many findings of simulator sickness in realistic tank and helicopter trainers. These results offer a new understanding of the phenomena that may be exploited to create solutions for improving training and real - time use of computer - generated imagery.

DTIC

Computerized Simulation; Visual Perception; Virtual Reality; Position (Location); Military Operations; Training Devices; Flight Simulators

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